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**The Effect of a High Calcium
Dairy Based Supplement on
Parameters of Bone Health in
Pre-Pubertal New Zealand
Children**

**A thesis presented in partial
fulfilment of the requirements for the
degree of Masters of Science in
Nutritional Science**

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Megan Joan Merrilees

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"You're not getting enough calcium."

Abstract

With an ageing population and an increased awareness of the rising health costs of fractures caused by osteoporosis (1); the focus of osteoporosis research is changing from treatment to prevention. More recent studies have looked at the effect of calcium supplementation during childhood and adolescence as a method of increasing the peak bone mass (2-10). It is postulated this will lead to a decrease in fractures in later life.

This study investigated the effect of a calcium enriched milk drink on bone density, bone mineral content and bone size in both male and female 8-10 year old New Zealand (NZ) pre-pubertal children.

One hundred and fifty four NZ pre-pubertal boys and girls were randomized to receive a high calcium dairy ($\text{Ca}^{2+} = 1200\text{mg}$) drink or a control ($\text{Ca}^{2+} = 400\text{mg}$) drink for 18 months. They were assessed at baseline and then every 6 months for the first 18 months, during the supplementation period; they were then followed up 12 months later. Bone mineral density, and bone mineral content was assessed at the total body, hip and spine. Indicators of bone size were measured at the spine. Anthropometric data was collected and Tanner stages of pubertal development, dietary calcium intake, compliance and medical questionnaires were administered. The calcium food frequency questionnaire was validated against a 3 day weighed food record at baseline.

There was no significant difference between the 2 groups for bone mineral density or bone mineral content observed either before or after the intervention. Trends were seen in bone mineral density in the total hip ($p=0.081$) and the trochanter ($p=0.088$). There was no difference in vertebral height or width at any stage of the study, indicating no additional influence on bone size. There were no significant differences between height, weight, lean mass or fat mass. Both groups had high habitual calcium intakes at baseline and this continued throughout the study, resulting in calcium intakes above the estimated calcium threshold for both groups.

In this 2½ year study (18 months supplementation, 1 year follow-up) there was no difference in bone mineral density in children aged 8-12 years. This is most likely due to a high habitual dietary calcium intake, that even with minimal addition of calcium to the diet a threshold level was reached where no further benefit was seen.

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Table of Contents

1	Introduction	1
2	Literature Review	3
2.1	Bone and Peak Bone Mass	5
2.1.1	Bone	5
2.1.2	Normal Peak Bone Mass	5
2.1.3	Puberty and Gender	9
2.1.4	Childhood Growth	11
2.1.5	Osteoporosis	12
2.1.6	Calcium Homeostasis	13
2.1.7	Recommended Dietary Intake	17
2.1.8	The Effect of Inadequate Intake	23
2.2	Trends in Consumption of Milk in New Zealand	24
2.3	The History of New Zealand's School Milk Programme	25
2.4	Current New Zealand Calcium Intake	27
2.4.1	Calcium Intake in Other Developed Countries	28
2.5	Other Nutritional Factors that Effect Bone	29
2.5.1	Protein	29
2.5.2	Vitamin D	33
2.5.3	Phosphorus	35
2.5.4	Magnesium	37
2.5.5	Vitamin K	38
2.5.6	Fluoride	38
2.6	Studies of Calcium Intervention and Bone Growth	40
2.7	Methods Used in Studies	45
2.7.1	Dietary Assessment	45
2.7.2	Measurements of Bone Accretion	48
2.7.3	Measures of Acceptability of Food Products	53
2.7.4	Research Design	54
2.8	Summary	54
3	Aims of the Study	56
4	Methodology	57
4.1	Subjects	57
4.2	Randomisation	57
4.3	Funding and Ethics Approval	59
4.4	Protocol	59
4.5	Dietary Compliance and Acceptability	60
4.6	Procedures	61
4.7	Measurement of Nutrient Intake	61
4.8	Statistical Analysis	62
5	Results	64
5.1	Physical Characteristics and Demographic Data	64
5.2	Medical History	66
5.2.1	Family History of Osteoporosis	66
5.2.2	Previous Fracture	66

5.2.3 Medications	66
5.3 Retention of Subjects	67
5.4 Compliance	69
5.5 Acceptability	71
5.6 Anthropometric Indicators	72
5.7 Bone Mineral Density	78
5.8 Bone Mineral Content	80
5.9 Bone Size	82
5.10 Calcium Intake	84
5.10.1 Comparison of calcium intakes from FFQ and 3 day food record	85
6 Discussion	87
6.1 Physical Characteristics and Demographic Data	88
6.2 Medical and Family History	90
6.3 Retention of Subjects	91
6.4 Compliance	92
6.5 Acceptability of the Product	94
6.6 Anthropometric Indicators	95
6.7 Bone Mineral Density and Bone Mineral Content	98
6.8 Bone Size	99
6.9 Dietary Calcium Intake	100
6.10 Validation of Dietary Calcium Intake	103
6.11 Limitations of the Study	105
6.12 Recommendations	108
7 Conclusions	112
8 References	116
9 Appendices	128
1 Invitation to participate (information sheet)	128
2 Consent form for the parents of the children	129
3 Consent form for the children participating in the study	130
4 Nutritional analysis of the supplement	131
5 Ethics Application	132
6 Visit sheet for data collection	133
7 Calcium food frequency questionnaire	134
8 Medical questionnaire	135
9 Tanner questionnaire for assessment of pubertal stage	136
10 Acceptability questionnaire	137
11 BMD Quality assurance manual for the study	138
12 3 day diet record booklet	139

List of Tables

2.1	<i>Review of the balance studies that have looked at calcium retention</i>	17
2.2	<i>The current United Kingdom recommended nutrient intakes for calcium in children</i>	19
2.3	<i>The current Australian recommended dietary intakes for calcium in children</i>	20
2.4	<i>The current USA/Canadian adequate intakes for calcium in children</i>	21
2.5	<i>Calcium supplementation intervention trials in children; a comparative matrix</i>	42
2.6	<i>Commonly used methods for collecting dietary data</i>	49
2.7	<i>Bone biomarkers and their use in children</i>	52
4.1	<i>Nutritional composition of 2 sachets of high calcium supplement compared to 2 sachets of the placebo supplement</i>	58
5.1	<i>Socio-economic indicators for the suburbs where the children and participating schools resided in Christchurch, compared to the National and Christchurch values.</i>	64
5.2	<i>Baseline characteristics of both groups</i>	65
5.3	<i>Difference in numbers per group from baseline</i>	68
5.4	<i>Height, weight, total body lean mass and fat mass for the treatment and control groups at baseline, 6, 12, 18 and 30 months</i>	72
5.5	<i>Percentage change from baseline fro the total body, lumbar spine, total hip, trochanter and femoral neck bone mineral density fro the treatment and control groups at 6, 12, 18 and 30 months</i>	78
5.6	<i>Bone mineral density values for the total body, lumbar spine, total hip, trochanter and femoral neck for the treatment and control groups at baseline, 6, 12, 18 and 30 months</i>	79
5.7	<i>Bone mineral content values for the total body, lumbar spine,</i>	81

total hip, trochanter and femoral neck for the treatment and control groups at baseline, 6, 12, 18 and 30 months

5.8	<i>Percentage change from baseline in parameters of bone size;L1-L4 lumbar spine width, area, height and volumetric density for 6, 12, 18 and 30 months</i>	82
5.9	<i>Parameters of bone size; L1-L4 lumbar spine width, area, height and volumetric density for 0, 6, 12, 18 and 30 months</i>	83
5.10	<i>Comparison of calcium intake assessed by 3-day food record and food frequency questionnaire at baseline</i>	85
5.11	<i>Cross-classification analysis for calcium intake from the 3-day food record and the calcium food frequency questionnaire</i>	85
6.1	<i>Calcium intake when compliance is considered during the supplementation period</i>	93

List of Figures

2.1	<i>Scatter-plot with Trewess smooth of bone mineral density of the whole body in premenopausal women.</i>	6
2.2	<i>Schematic lifetime presentation of bone mass and fracture risk</i>	10
2.3	<i>Change in growth velocity during childhood and adolescence</i>	12
2.4	<i>Photographic representation of normal bone matrix compared to osteoporotic matrix</i>	13
2.5	<i>The effect of the major hormones on calcium balance in the healthy adult</i>	14
2.6	<i>Milk consumption per capita in New Zealand (1945-1998)</i>	24
2.7	<i>How differing levels of dietary protein and dietary calcium effect bone health.</i>	32
2.8	<i>Proposed model of adaptation to a high phosphate diet</i>	36
5.1	<i>Ethnic nationalities of the children participating in the study</i>	65
5.2	<i>Reasons for withdrawal from taking the milk supplement</i>	67
5.3	<i>Mean percentage compliance of the supplement for the children who completed the supplementation period</i>	69
5.4	<i>Mean percentage compliance for the milk supplement if the children who withdrew are included</i>	70
5.5	<i>What the children thought of the milk supplement throughout the study</i>	71
5.6	<i>How many glasses of the milk supplement the children thought they could drink at one time during the supplementation period</i>	71
5.7	<i>Stage of pubertal development at baseline and 30 months</i>	73
5.8	<i>NCHS growth curves for weights for boys aged 2-18 years showing mean weight during the study.</i>	74
5.9	<i>NCHS growth curves for heights for boys aged 2-18 years</i>	75

showing mean height during the study.

5.10	<i>NCHS growth curves for weights for girls aged 2-18 years showing mean weight during the study.</i>	76
5.11	<i>NCHS growth curves for heights for girls aged 2-18 years showing mean height during the study.</i>	77
5.12	<i>Percentage change from baseline for the total body, lumbar spine, total hip and femoral neck bone mineral content at 6, 12, 18 and 30 months</i>	80
5.13	<i>Comparison between the habitual calcium intake in the treatment and control groups throughout the study</i>	84
6.1	<i>Differences in the calcium intakes in the intervention trials that have been carried out in pre-pubertal children</i>	103

List of Abbreviations Used

<i>Abbreviation</i>	<i>Full word(s)</i>	<i>Abbreviation</i>	<i>Full word(s)</i>
BMD	Bone mineral density	PICP	Procollagen 1 carboxy-terminal propeptide
DEXA	Dual energy x-ray absorptiometry	HPro	Hydroxyproline
PBM	Peak bone mass	Pyr	Pyridinoline
OA	Oligo-amenorrhoeic	DPyr	Deoxypyridinoline
EA	Eumenorrhoeic	TRAP	Plasma tartrate-resistant acid phosphatase
OCA	Oral contraceptive users	Hyl	Hydroxylysine and glycosides
PTH	Parathyroid hormone	kJ	kilojoules
BMC	Bone mineral content	kcal	calories
QCT	Quantitative computed tomography	g	grams
mg/d	milligrams per day	µg	microgram
mg	milligrams	IU	International units
%	percent	mA	milliAmps
RDI	Recommended daily intake	kg	kilograms
AI	Adequate intake	mm	millimetres
USA	United States of America	n	number
NZ	New Zealand	SPSS	Statistical package for social sciences
UL	Tolerable upper intake level	SEM	Standard error of mean
IGF-1	Insulin-like growth factor-1	PRN	As often as required
hr	hour	NCHS	National children's health survey
DASH	Dietary approaches to stopping hypertension study	L1-L4	Lumber 1 to lumber 4
1,25(OH) ₂ D	1,25-dihydroxyvitain D	FMV	First morning volume
FFQ	Food frequency questionnaire	BAP	Bone alkaline phosphatase
OC	Osteocalcin		